For the infection of the kidney and ureter an absolute milk diet must be instituted. Salol, urotropin, and the balsams have their indications. When there is retention with infection, some favorable results may be obtained by distention of the bladder, as advised by Pasteau. It is well known that distention of the bladder produces an increase of the renal secretions, as well as of the contractility of the excretory apparatus. Therefore, Pasteau injects from 150 to 160 c.c. of tepid boric acid solution very slowly into the bladder; this is repeated three times a day, the patient being requested to retain the fluid in the bladder as long as possible. It should be pointed out that this treatment is absolutely contra-indicated when cystitis is present.

As to surgical treatment, nephrotomy is probably the only operation required, and from an examination of the literature it appears that it has rarely been necessary to resort to it. Nephrectomy, which is an extreme and radical resource, has never been required in cases of pyelonephritis occurring postpartum, so far as I am aware.

THE ANATOMY AND PATHOLOGY OF THE CAROTID GLAND.

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This work was undertaken primarily to determine the effect of various systemic diseases on the carotid gland; incidentally, the anatomy and histology of the gland have also been closely observed. A review of the literature was given by Kohn,[1] in 1900, and by Funke,[2] in 1904. A summary of the cases of tumors of this organ, reported up to the time of their publication, was given by Keen and Funke,[3] in 1906. Therefore, it does not seem at present necessary to go over the literature, and I shall proceed to a description of my own findings.

Material and Technique. Human material was obtained as fresh as possible from the cadavers at necropsies performed in various hospitals of Chicago, and particularly the Cook County Hospital. Fifty human cases altogether were examined; and from animals killed at the Hull Laboratories and at Armour & Co.'s Union Stock Yards, material was taken for comparative study. Fixation was by Zenker's fluid.[4] In the first 22 human cases, and

[1] Archiv f. mikro. Anat., 1900, vol. lvi, p. 81.

[2] American Medicine, 1904, vol. viii, p. 109.

[3] Jour. Amer. Med. Assoc., 1906, vol. xlvii, pp. 469 and 566.

[4] Kohn recommends a mixture of formalin and potassium bichromate. Staining was done with Delafield's hematoxylin and eosin, Van Gieson's, and Mallory's reticulum stains.

in all animal material, pieces of tissue about an inch in average length, including the common, internal, and external carotid arteries, with some branches of these, were embedded in celloidin. The tissues were then cut at various levels of about 100 microns intervals, cutting three or four sections at each level, of about 12 microns in average thickness. The sections were stained with hematoxylin and eosin and search was made for the gland. On cutting blocks of tissue in this way, in many cases it was possible to tell by the naked eye whether the gland was at the level reached; it showed itself as a clump of tissue closely related to the outer coat of the arteries, pinkish white, sometimes lobulated, sometimes uniform, in appearance. Three kinds of tissues were constant sources of confusion: (*a*) A ganglion of the sympathetic nervous system, which is usually uniformly whitish in appearance, but is not closely adherent to the adventitia of the carotid bloodvessels. (*b*) A nerve trunk, the fasciculi of which on cross section resemble the lobules of the carotid gland; this nerve trunk was either the vagus or sympathetic; in the first instance it was not attached closely to the outer coat, and in no case was it found posterior or anterior to the bifurcation of the carotid artery, but occupied always the lateral side. When the nerve trunk was sympathetic it was sometimes cut obliquely, so that a lobular formation was not shown; it resembled a clump of connective tissue, which was not adherent, however, to the adventitia. (*c*) A clump of fibrous connective tissue, which is adherent to the adventitia, but differs generally from the carotid gland by the dead white color and its uniformly dense appearance; in several cases, however, the gland presented exactly the appearance described, and only microscopic examination decided the real nature of the tissue.

Therefore, in macroscopic examination of blocks of tissue cut transversely the points of differentiation were (1) pinkish white color; (2) lobulation or uniformity; (3) close relationship to adventitia, into which the capsule of the carotid gland seems to merge. The presence or absence of the gland was considered established only after a careful microscopic examination of the stained sections.

This method of finding the gland is very valuable, since sometimes the gland, either because it was very small or was concealed in the adventitia, escaped detection by macroscopic dissection. It is the only reliable method for finding the gland in lower mammals, since in these it is relatively small, and the surrounding connective tissue is much thicker and denser than in man.

Beginning with Case XXIII, the attempt was made to dissect out the gland, and in almost every case this could be successfully done. When it was located, either the gland alone or a piece of bloodvessel with it was embedded in colloidin or paraffin. In dissecting out the gland fresh material was always used, because hardening fluids tend also to empty the bloodvessels and capillaries and coagulate the tissues; thus the reddish appearance could not be well distinguished. It is not uniformly red, but rather mottled with light red and dark red points. In this dissection the gland is again to be distinguished from (*a*) connective tissue, which is paler, uniform, and can be broken into fibers; (*b*) lymph glands in the intercarotidal tissue, which are sometimes hyperplastic, although usually they cannot be seen. If they are hyperplastic, they are usually uniformly red in appearance and detached from the wall of the bloodvessels. In one case the carotid gland was found hanging from the external carotid artery by a fibrous stump, and was so surrounded with fat that it appeared very much like the lymphatic glands (which were enlarged in this case probably on account of tuberculosis of the lung); only its attachment to the artery guided me to keep the tissue for further examination, and to my surprise microscopically it turned out to be the carotid gland. (*c*) It also has to be distinguished from ganglia of the sympathetic, which are, however, of the white color of the nerve, are connected with the sympathetic cord, and not attached to the adventitia of the carotids.

ANATOMY AND TOPOGRAPHY. The carotid gland is generally described as a reddish ovoid organ of firm consistency, the longest axis being vertical, the upper pole broader than the lower, lying on the posterior surface of the bifurcation of the common carotid artery, and not constantly present in man. Funke states that he found it most frequently on the inner and posterior side of the internal carotid. Schaper[5] states that the gland is spindle-shaped, and that in man it is more regular in size and shape than in other mammals. Its size varies, according to different authors: Luschka[6] gives it as 7 by 4 by 2 mm., Schaper as 5 to 7 by 2, 5 to 4 by 1.5 mm. A fibroelastic stump connecting the gland with the bloodvessel on which it lies, and carrying its artery, is described as the "ligament of Mayer." Most authors agree that there is only one nutrient artery springing from the one of the carotid arteries on which the gland lies. Henle[7] states that it receives two or three branchlets from the *carotis primitiva* (common carotid). Poirier and Charpy, speaking about the relation of the gland to the nerves, state that a great number of filaments surround it, either directly or after forming a plexus, the intercarotidal plexus, the filaments of which come from the superior cervical sympathetic ganglion, the *nervi molles* of Haller, the glossopharyngeal, hypoglossal, and superior laryngeal.

In my own experience I found the shape of the gland generally ovoid, in several cases rounded, and in a few elongated. In the majority of cases it was found single on each side of the neck. Luschka has observed the occasional splitting of the organ into two lobes, and my findings confirm his statement. The gland on the left side in Case XLI was remarkably flattened, and on the free edge there was a depression, which, however, was not deep enough to make the gland a uniform shape. In Case XXIX, on the left side, the gland was elongated and constricted at the middle, dividing it into two lobes

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[5] Archiv f. mikro. Anat., 1892, xl, p. 287.

[6] Archiv f. Anat. u. Physiol., 1862, p. 406.

[7] Cited by Poirier et Charpy, Traité d'anatomie humain, Paris, 1901, tome ii, p. 668.

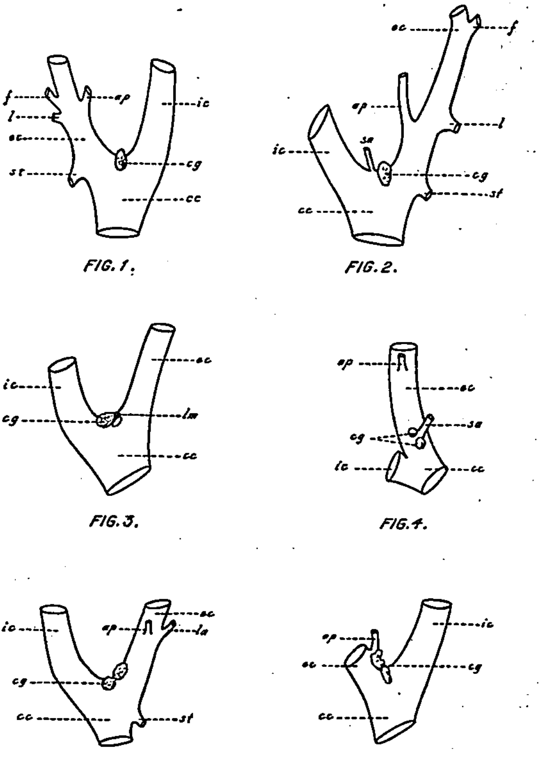

FIG. 1. FIG. 2.

FIG. 3. FIG. 4.

FIG. 5. FIG. 6.

The carotid gland, posterior views, illustrating its gross anatomy and variations in location. Fig. 1. The most common form. Figs. 2–6. Several other types described in the text. *Cc*, common carotid artery; *Ec*, external carotid; *Ic*, internal carotid; *Sa*, small anonymous artery; *Ap*, ascending pharyngeal; *St*, superior thyroid; *L*, lingual; *F*, facial; *Cg*, carotid gland; *Lm*, ligament of Mayer.

united by an isthmus (Fig. 5). In Cases XXXV (Fig. 4) and XXXIII there were two distinct and well defined bodies on the left side. The gland was measured macroscopically every time that it was possible to do so, by carefully dissecting out the fat, including the connective tissue capsule and the glandular tissue in the mensuration. My measurements agree with those of other authors as to the variability of the gland in size. Out of twenty-six measurements, the average is 5 mm. in length, 3 mm. in breadth, and 2.5 mm. in thickness—an average diameter of 3.5 mm. The largest gland was 8 by 5 by 4 mm. The smallest was not detectable by naked eye inspection; only under the microscope was its presence established, and it was 0.5 mm. in diameter.[5]

As to the position of the gland, I also found it most commonly between the internal and external carotid arteries, resting posteriorly on the bifurcation of the common carotid, the ligament of Mayer being attached to the artery on which it lies (Fig. 1). Variations from the usual location are the following: In Case XXIV, on the right side, the gland was hanging by the ligament of Mayer to the outer side of the external carotid, 3 mm. above the bifucration; in Case XXXI, on the left side, it was placed in front of the ascending pharyngeal artery, which arose at a lower level; in Case XXVIII, on the right side, it was a little elongated, placed upon the middle, not behind the bifurcation; in Case XXXVII, the right side was elongated, resting on the groove of the bifurcation superiorly and posteriorly, its upper pole being in close relationship with the ascending pharyngeal artery and deviating somewhat to the right of this, the lower pole resting posteriorly on the bifurcation (Fig. 6). In several other cases it was more intimately attached to the external than to the internal carotid. In one case the ligament of Mayer was not attached to the artery on which the gland was lying; the gland resting on the inner surface of the internal carotid about 1.5 mm. above the bifurcation, while the ligament of Mayer, with its contained bloodvessel, stretched across the intercarotidal space, to be attached to the external carotid, into which the carotid gland artery opened (Fig. 3). In 5 cases (on only one side in 3 cases, and on both in 2) a small artery sprang from the bifurcation of the common carotid, and in every case the gland was intimately related to it, either embracing or directly adjacent to it (Fig. 2). Of the two lobules of Case XXXV, the one was anterior, the other lateral to this small artery (Fig. 4). I am not aware of any name given to this artery.

The gland was found only once in 8 human fœtuses examined by Funke, who apparently examined no adult material. Out of 50 human cases of my own it was found present in all but 5. In 4 cases it was found only on one side, and in 1 of these last cases the only carotid body present was much enlarged (about 5 mm. in average diameter), as though a compensatory hypertrophy had taken place.

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[5] The gland increases in size as the individual grows, from proliferation of the parenchyma, bloodvessels, and connective tissue.

Speaking of the comparative anatomy of the carotid gland, Schaper[9] concludes: "It is probably present in all mammals. A homologous organ is not found in birds, at least in the neighborhood of the bifurcation of the carotid artery. The so-called carotid gland of batrachians and salamanders is not homologous with the one in mammals. In fishes it has not yet been observed, but the *Axillarherzen* that Rochen and Haien found, and about which von Leydig wrote, are probably of the same nature." Kohn's findings confirm Schaper's conclusions. Funke was not successful in finding the gland in lower animals (cat, rabbit, and guinea-pig).

By taking pieces of tissue containing the bifurcation of the carotid artery and cutting sections at 100 μ intervals, I was able to find it in cats, dogs, oxen, goats, and monkeys. In these animals the gland in every case was too small for macroscopic dissection, and the connective tissue capsule was so thick and dense that no characteristic external appearance of the gland is shown. I agree with Schaper as to the variability of its position in mammals; in general it is placed posterior to the bifurcation, more closely attached to one artery than to the others. In the ox the gland was found somewhere in the neighborhood of the division of the common carotid artery into internal and external maxillary and occipital arteries,[10] and it was divided into two separate lobes.

EMBRYOLOGY AND HISTOLOGY. There are three theories as to the embryology of the carotid gland (see Keen and Funke): (1) Endodermal, which holds that the gland is derived from the third or fourth branchial cleft, as is claimed by Stieda, Rabl, Pierre du Meuron, and others. (2) Endothelial, as is believed by Katschenko, and confirmed by Paltauf and Szymonowickz, from the endothelium of the carotid artery, the first sign of the gland being a cellular thickening in the adventitia of one of the bloodvessels. (3) Nervous, propounded by Kohn, on account of his having found chromaffin cells corresponding to those in the sympathetic ganglia, and he says it belongs to a category of its own. The nervous origin was long ago suspected by Luschka, on account of its close relationship to the sympathetic nervous system, thus resembling the pituitary body, the suprarenal gland, and the coccygeal body.

Luschka first described the histological structure of the carotid body, and concluded that it is glandular, made up of tubules and vesicles, the formed elements being molecular masses with naked nuclei and cells, the nucleus being partly dark, partly granular, with a nucleolus, the cells being mostly elongated, and also polygonal or irregular, showing sometimes great similarity to cylindrical epithelium. Arnold,[11] on the other hand, held that the gland is of glomerular structure, and states that the tubules and vesicles of Luschka were only apparent; he believed free cells, nuclei, and molecular masses were not present.

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[9] Archiv f. mikro. Anat., 1892, xl, p. 287.

[10] Martin. Lehrbuch der Anatomie der Hausthiere, 1904, vol. ii.

Both authors were partly right, however, as is found by recent investigations, and now it is considered established that the gland is made up essentially of two parts: (1) Capillary bloodvessels, richly anastomosed, forming a sort of tuft; and (2) cells, epithelioid in character, situated in the interstices limited by the bloodvesels. The gland is surrounded by a dense fibrous (white and elastic) connective tissue capsule, from which prolongations are sent in, dividing the gland into lobules, which are again divided by delicate strands of connective tissue, inclosing the "Zellballen" of Schaper. It is maintained by Marchand[12] that there exists a hilum structure where the artery enters the gland, and then gives up one branch for each lobule, which in turn is broken up into capillary glomeruli, around which the formed elements are arranged. The efferent vessels from these tufts are gathered at the periphery of the organ into wide, thin-walled veins. The capsule contains both medullated and non-medullated fibers. Ganglion cells are scattered and few in number. Paltauf[13] found a connective tissue reticulum, which is regarded as a postmortem alteration by Schaper.

The formed elements are described as cells with cuboidal, polygonal, sometimes irregular, outline, similar to epithelium, with rounded or oval intense staining nucleus, often eccentrically placed, and containing a nucleolus. Mönckeberg describes an angular form of nucleus. The protoplasm is somewhat granular and small in amount. Frey[14] likens the parenchyma to the plasma cells of Waldeyer. I have observed very carefully the cells stained with hematoxylin and eosin and fixed in Zenker's fluid, and two types of cells seem to be evident in most cases. The protoplasm of each kind is similar in character, and they differ principally in the character of the nucleus. In one (type I) this is large, rounded or ovoid, vesicular, with chromatin granules distinct, and a dot of chromatin or nucleolus at the center. In the other (type II) the nucleus is smaller, similar to the lymphoid cell nucleus, rounded, dense, uniformly dark blue stained, with the distinct chromatin granules. In the majority of cases the cells of the second type predominate, in a few those of the first. In cases in which the cells were only of one type, the second type was the one present.

Among the cells of the "cell balls" and in the stroma, Stilling[15] found a kind of cell which stains brown by neutral salts of chromic acid. Kohn confirmed Stilling's observations, and calls these

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[11] Virchow's Archiv, 1865, vol. xxxiii, p. 194.

[12] Virchow's Festschrift, 1891, vol. i, p. 537.

[13] Ziegler's Beiträge, 1892, vol. xi, p. 266.

[14] Cited by Paltauf.

[15] Cited by Kohn.

"chromaffin cells." Similar chromaffin celis are present in the adrenal, and some authors consider the chromaffin substance to be the cause of the effect of the gland extract upon blood pressure.

Recently Mulon[16] succeeded in producing a rise of arterial blood pressure, and sometimes an acceleration of the beat and force of the heart, by injecting watery extracts of the carotid gland of horses into the viens of rabbits, and he attributes this effect to the chromaffin cells of the gland. I tried on a cat two injections of glycerin extracts of equal quantities of material from human carotid glands, and I found invariably a *lowering* of blood pressure. These experiments will be repeated as soon as a suitable amount of material is obtained, and a more detailed account will be published later.

Concerning the relationship between the parenchyma cells and the capillaries, authors divide themselves, Reclus and Chevassu[17] say, into two sides. Some, with Eberth, Marchand, and Paltauf, see between the cells and the capillaries a very intimate relationship, the epithelioid cells being outgrowths from the vascular epithelium, and cite the endothelial origin of the gland as a support of their contention. Others, with Luschka and Stilling, consider that between the vessels and cells there is a true independence; they liken the carotid body to the suprarenal gland, the carotid body deserving at all points the name of blood vascular organ, and cite the endodermal origin of the gland for their support. Kohn says it is neither a gland nor entirely an epithelial structure, but belongs to a category of its own.

In my own cases, when the capillaries were found greatly distended with blood, the relationship belween the epithelioid cells and the capillaries was more intimate, and they appeared to line the capillary lumina directly. When the bloodvessels were empty, however, fine fibrils of connective tissue seemed to separate the epithelioid cells from the endothelial lining of the capillaries.

In lower mammals Schaper found that the connective tissue of the carotid gland is less in amount than in the human, and he likens them to the younger stages of human carotid body. Kohn[18] describes four types of carotid gland, according to the degree of development of the connective tissue and the degree of division of the parenchyma. (1) "Compact type," a good example of which is the organ of the cat, which is characterized by fine interstitial connective tissue, so that the cellular appearance is more pronounced and a more parenchymatous constitution is shown. (2) "Lobular type," in which a greater amount of connective tissue divides the gland into lobules, pronounced in apes (*macacus rhesus*). (3) "Granular type," in which further subdivision of lobular into small granules (Zellballen) occurs, through an increased amount of connective tissue; this is the human type. (4) The "diffuse type," in which the cells are arranged in small globular groups, or small short strings, lying apparently independent of each other in the connect-tissue; this type is present in rabbits.

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[16] Archives gén. de médecine, 1904, p. 3265.

[17] Rev. de chir., 1903, vol. xxviii, p. 157.

[18] Loc. cit.

My findings agree with those of Schaper in regard to the relative amount of connective tissue. In addition, it was noticed that the carotid gland of the mammals observed contained only one kind of cells, cuboidal in shape, with the nucleus large, rounded, and vesicular, showing distinct chromatic granules and a nucleolus; hence, they correspond to type I of the cells found in human glands. In general it may be said that the carotid gland of the cat, dog, goat, ox, and monkey in my cases had more of a parenchymatous appearance than in man. In the goat, monkey, and cat it is of a more compact type. In oxen the gland appears of a granular type, little individual groups of cells in more of an alveolar arrangement, and separated by fine strands of connective tissue. The dog's carotid gland has a greater development of ~~connective tissue, and approaches~~ to ~~the~~ young human gland in appearance~~, while the~~ others ~~(goat, monkey, cat, and ox glands)~~ are more parenchymatous than in young stages of the human gland. In monkeys, at about the bifurcation of the carotid artery, a lymphatic gland is constantly found, which was at first thought to be the carotid gland.

PATHOLOGY. Only tumors of the carotid gland have been reported so far. I am not aware of any description of other diseases of this organ.

Tumors. The increasing number of cases reported within the last few years, and the possibility of mistake in the diagnosis of tumors of the neck, make one suspect that these tumors are not so infrequent as was formerly believed. Keen and Funke collected 29 cases: 27 observed in the living, and 2 discovered on autopsy. Hutchinson's[19] 8 cases of "potato tumors" are probably newgrowths of this kind. Their etiology is unknown; some coincidences with other diseases, such as tonsillitis in one case, buccal phlegmonous inflammation following extraction of a tooth in another, have been mentioned in attempting to indicate the ultimate exciting causes, but there does not seem to be enough foundation to attribute any special significance to these facts. There is no sex influence. They occur particularly in adolescence and adult life, cases having been observed from the eighteenth to the sixtieth year, mostly about the thirtieth. V. Heinleth[20] attempts to explain their formation by stating that the carotid body develops until puberty, when it either atrophies or development is arrested; if it continues to grow, a tumor is formed.

The tumors are usually oval in shape, the size varying from a pigeon egg to a goose egg. The consistency is variable, but it is usually moderately hard and elastic. The color varies from a reddish gray to a gray or brown. There is always a fibrous capsule which sends septa into the tumor. There are much enlarged veins on the surface, and the bloodvessels are so abundant that a sponge-like appearance is shown on the cut surface. They are usually intimately adherent to the common carotid artery and its branches, but in a few cases they could be peeled off easily. It can be said that their histology shows hyperplasia of the cells around the bloodvessels and the name of endothelioma is most generally accepted, since the most accepted embryological view of the origin of the gland at present is endothelial. The connective tissue septa are apt to undergo hyaline degeneration. The tumor cells are cubical, spindle, triangular, or polydehral in shape. Some have found processes from the angular cells, which seemed to be intimately connected with the capillaries. Chromaffin cells are also found, either in the alveoli or in the stroma. Some fuchsinophile cells are described by Keen and Funke.

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[19] Illustrated Medical News, October 18, 1888, and also November 3, 1888.

[20] Münch. med. Woch., 1900, vol. xlvii, p. 899; and also Centl. f. allg. path. u. Path. Anat 1900, vol. xi, p. 599.

The tumors are benign in the early stages; later they grow very rapidly, and not until then do they usually come to be noticed by surgeons. They have a marked tendency to adhere to the surrounding structures, the pneumogastric, the sympathetic, the hypoglossal, and the lingual nerves. In 1 case the tumor was adherent to the anterior surface of the cervical vertebræ; in 2 it reached the base of the skull; in another it bulged into the pharynx. In 5 cases there was enlargement of the neighboring lymphatic glands; in 1 other metastases in the liver were found postmortem; in another the growth was distinctly malignant, rapid wasting occurred, and the patient died without operation. In 4 cases there was recurrence after operation, probably on account of the incomplete removal of the cells of the gland.

Sclerosis. By this term is meant an increase of connective tissue of the carotid gland. This occurs in old age and in patients with syphilis of the carotid artery, whereby an arteriosclerosis is produced. Schaper found that in old age spontaneous dissolution of the cells and increase in connective tissue and bloodvessels occur. Careful examination of all the specimens I obtained, taking into consideration the age of the individual and the amount of connective tissue and sclerosis in the intima of the corresponding carotid artery, revealed the fact that sclerosis of the gland is always associated with sclerosis of the intima of the carotid artery, and the former is proportional to the latter. The process seems to start from the adventitia of the carotid artery, for the interlobular septa first increase in volume, thickness, and proliferative activity, as shown by round cells, elongated endothelioid cells, spindle-shaped cells, and young strands of fibrous connective tissue. In young individuals the connective tissue is very slight in amount, the cell balls seem to fuse with each other, and even the lobules are not very well defined. As age, or, what is similar, arteriosclerosis, advances, proliferative changes take place, and the interlobular and intralobular connective tissue becomes more evident, separating the elements of the gland into lobules and cell balls; when arteriosclerosis becomes more marked the connective-tissue elements preponderate, the bloodvessels of the interlobular septa become sclerosed, the cell balls atrophied, and eventually the connective tissue, becoming denser and denser, undergoes hyaline degeneration.

Arteriosclerosis produced by syphilis in one case offers an instructive picture.

Case XXXIII.—Male, aged forty-six years.

Anatomical Diagnosis. Aortic insufficiency and syphilitic aortitis.

Gross Description of the Gland. Only the carotid gland of the right side was obtained. It is made up of fairly distinct lobes, connected with each other by a fibrous vascular band. The larger one is on the posterior surface of the bifurcation, size 8 by 5 by 4 mm., a great deal larger than normal; smaller one located posterior to the internal carotid artery; size 3 by 2 by 4 mm. The arteries are thickened, and patchy calcification of the intima is present. Careful search for the opening of the artery into the carotid body failed to locate it.

Histological Description. The majority of the parenchyma cells are of the small type, with densely staining nuclei. A very striking amount of proliferative changes in the connective tissue, which is very cellular (lymphoid cells, endothelioid cells, and spindle-shaped cells) is present. The cell balls are well bounded by fibrocellular connective tissue. The cells of the stroma are increased, and in fact they seem to predominate, in the cell balls. The bloodvessels are not thickened, on the contrary, they seemed to be thinned by the great bulk of blood that they contain. As the opening of the main bloodvessel of the carotid gland is obliterated and no necrosis of the gland followed, it may be concluded that a good anastomosis with the vasa vasorum took place.

Cloudy Swelling. It was expected that the carotid gland would be affected by toxins and bacteria in the blood. I examined 11 cases of acute and chronic nephritis, 2 of septicemia, 1 of typhoid, 7 of pneumonia, and 2 monkeys (obtained from Dr. H. T. Ricketts) which died of Rocky Mountain Spotted Fever. These infectious and toxic processes, taken as a whole, had very little effect on the carotid gland. Only in one case was a marked change observed.

Case L.—Male, aged sixty-four years; autopsy twelve hours after death.

Anatomical Diagnosis. Lobar pneumonia.

Gross Description. Only the right side was examined. Gland was about 2 mm. in diameter, placed posteriorly on the bifurcation. It looked small and sclerosed.

Histological Appearance. Gland sclerosed. The parenchyma under low power shows indefinite, dark-staining patches; with high power the parenchyma cells are seen to be somewhat swollen, more distinctly granular, boundaries altogether obliterated, fusing into one degenerated mass with scattered dark nuclei. This is cloudy swelling, but it does not extend to all the cell balls.

In several cases of septicemia the blood was laked, showing the effect of infection, and yet the cells of the gland seem to have altogether escaped pathological alteration.

Hyaline Degeneration. In tumors, hyaline degeneration of the connective tissue has been described by Keen and Funke, Monckeberg, Paltauf, and Kopfstein,[21] due probably to fusion of the fibers and subsequent homogeneous appearance.

As the gland grows older, the connective tissue increases in volume and density, and eventually becomes homogeneous in appearance, and hyaline degeneration takes place. This was particularly marked in Case XLIV (a male, aged forty-five years, dead of septicemia) in which the connective tissue made up half of the volume of the gland.

Other Changes. In Case XXXVII, a male, aged fifty-seven years, dead of chronic nephritis, there was found one very curious lobule. This was choked full of lymphoid cells, which were rounded in shape, poor in protoplasm, with dark, rounded nuclei without visible nucleoli. These must have sprung from the preëxisting connective tissue cells and from the blood stream, since neighboring bloodvessels showed slight increase of lymphocytes. In this particular lobule there were a few parenchymatous cells scattered here and there, as though the round cells had grown in among them and pressed them apart.

Four cases of miliary tuberculosis, and 4 of other kinds of tuberculosis were examined. In one case, a male of about twenty to twenty-five years of age, the tuberculosis was so generalized that even the intima of the arteries seemed to be riddled with millet seed tubercles; and yet in this case, as well as in all the rest, the carotid gland escaped infection.

Examination of glands from the following showed no pathological alteration: One case of multiple myeloma involving the frontal lobe of the brain, 1 case of pseudoleukemia, 1 of glioma of the brain, 1 of glioma of the retina, 4 of heart disease, 1 of gas poisoning, 1 of unknown poisoning, 1 of aortic aneurysm, 3 of cerebral hemorrhage.

Postmortem Changes. Schaper says that the cells contain a delicate hyaloplasm, and it is hard to preserve them true to life. This is the experience of all subsequent investigators. Comparing the animal material which was fresh, and the human material which was

[21] See Keen and Funke

obtained a varying length of time after death, I came to the conclusion that the granules of the protoplasm in the latter seem to dissolve at the periphery, and consequently they are relatively more granular toward the centre around the nucleus, and poorly defined vacuoles are formed apparently by dissolution of these granules. With longer standing, the protoplasm stains very poorly,, the edges being ragged in appearance. I had cases examined up to six days postmortem, and the cells do not seem to dissolve entirely, as in the case of the medullary substance of the suprarenal capsule.

SUMMARY. 1. The carotid gland is variable in size, shape, position, and number; it is not always present, or at least cannot always be found in its usual location, and may be absent on both sides or only on one side.

2. It is probably present in all mammals, and is more of a parenchymatous character and more intimately embedded in the adventitia of the carotid arteries in the lower animals than in man.

3. It increases in size as the indvidual grows, because of increase of connective tissue, bloodvessels, and parenchyma. Reaching a certain stage, between twenty and thirty years, it remains stationary for a time, and then only the connective tissue increases, the interlobular bloodvessels thicken, and sclerosis and atrophy of the gland result.

4. There are two types of parenchyma cells, differing mainly in the amount of chromatin and the size of the nucleus. The parenchyma cells of lower mammals are only of one type, which is more similar to the type in man which is characterized by a large rounded vesicular nucleus.

5. The sclerosis of the gland is proportional to the sclerosis of the intima of the carotid bloodvessels, whether due to age or to syphilitic endarteritis.

6. The gland is not very much affected by systemic diseases, the only changes found being one case of cloudy swelling, one of lymphoid infiltration, and frequently hyaline degeneration of the sclerosed stroma in old age.

7. The cells undergo postmortem changes readily, but do not dissolve entirely, as do the cells of the medulla of the suprarenal.

8. The nature of my material was such that no conclusions can be drawn concerning the chromaffin cells.

This work has been suggested by and done under the supervision of Dr. H. Gideon Wells. Drs. Le Count and Bassoe and Mr. Rosenberg have provided facilities for the obtaining of material. Dr. Warren H. Hunter kindly allowed me to get material from his numerous autopsies. To all of them I wish to express my deepest gratitude.